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A LEAFHOPPER PEST OF CLOVER
AND ALFALFA

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A Leafhopper Pest of Clover and Alfalfa

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An insect known as the Potato Leafhopper is of economic importance because of its attack on clover and alfalfa. Infested plants are more or less dwarfed and unthrifty in appearance. Young plants of both clover and alfalfa may die from the effects of leafhopper injury. The leaves of alfalfa become yellow, and those of clover, yellow, pink, bronze, red or brown. This condition of alfalfa plants is not present in early spring but may appear about the time of the first cutting, or soon thereafter. The trouble becomes more noticeable as the summer advances, but practically disappears in the fall. This dwarfing and discoloring of the leaves of clover and alfalfa were attributed by different investigators, to various causes such as sun scald, physiological condition of the plants, root diseases, soil conditions, unbalanced soil fertility, or other factors.

THE INSECT

The Potato Leafhopper is a slender, pale green insect about one-eighth of an inch long. The mature adults have white marks on the head and face, a row of eight spots just behind the head and a broad H between these. The adults are active and fly when disturbed. The young hoppers, or nymphs, feed on the under sides of the leaves and may also be found on stems and petioles. They are light green, wingless and, when disturbed, run with a sidewise movement across the leaf. The older nymphs may jump when disturbed. Both adults and nymphs have beaks for piercing the tissues of plants and sucking juice.

DISTRIBUTION AND SEASONAL HISTORY

The Potato Leafhopper is distributed generally in the United States and is known for its injury to clovers, alfalfa, beans, potatoes and other plants. The insect breeds in Florida and the Gulf States on alfalfa and similar crops during the winter and becomes very

numerous there in March and April. Published reports indicate that the insect passes the winter as an adult, but there are no authentic records for this conclusion. There is, also, no positive evidence that the leafhoppers over-winter in the egg stage. They appear here abruptly in the fields late in the spring, on alfalfa and potatoes, and it is now generally believed that this sudden appearance of large numbers of adults is due to migration from the Gulf States. Observations in the field during the seasons of 1928 to 1933 showed that adult hoppers appear in numbers on alfalfa about June 1 and are most numerous about July 25 or a little later. After August 1, the number decreases rapidly. The midseason generation of hoppers is the one most destructive to alfalfa.

RESISTANCE OF DIFFERENT CLOVERS

Certain strains of clover are more resistant to leafhopper injury than others. This was found to be true after several seasons of observations and experiments with various lots of clover grown from seed from foreign sources and from different regions of the United States. Italian and French clover were the least resistant to hopper injury. The French clover was only slightly less affected than the Italian. These two clovers are non-pubescent or have appressed hairs on the leaves. As regards resistance to leafhopper injury, neither of these clovers is satisfactory for sowing in Kentucky.

The native red clovers differ widely in their resistance to the injury. These strains have hairy foliage in contrast to the smooth Italian and French plants. Several native strains were tested for injury by the leafhopper, but only two, one from Kentucky and one from Tennessee, showed any great amount of resistance. The Kentucky strain was superior to the Tennessee strain. It should be used for sowing in Kentucky because it is adapted to this region and possesses resistance to leafhopper injury.

Several strains of alfalfa were kept under observation for a number of seasons to study their resistance to leafhopper injury. All were more or less dwarfed by the injury and there was a decided yellowing of the leaves. Slight differences in resistance were observed, but none was sufficiently marked to render any one strain greatly superior to another.

LEAFHOPPER INJURY AND WINTER HARDINESS

The failure or partial failure of clover is not an uncommon occurrence in Kentucky, and apparently the same situation is developing with regard to alfalfa in the older alfalfa-growing sections of the State. Especially on good soil, the leafhopper sometimes may be the causal agent of failures which occur or have their beginnings in midsummer or a little later. Usually, under field conditions, the injury from leafhoppers is not severe enough to cause the death of plants before winter, but the plants are weakened. For three seasons, plants infested during the summer were examined in the spring for winter injury or winter-killing. There was no appreciable difference in the amount of winter-killing, but the plants that had been infested were slightly smaller than uninfested ones.

WHEN TO CUT ALFALFA

Injury by the leafhopper causes alfalfa to turn yellow, and lessens the yield. Yellowed alfalfa hay has less sales value, because it lacks the green color of better grades of hay. Analyses indicate that yellowed leaves are lower in protein than normal leaves, but the stems are not affected. Before it was learned that the yellowing was caused by leafhopper injury, the general recommendation was to cut alfalfa when it became stunted and yellowed. However, cutting at this stage did little more than check the yellowing temporarily, especially when the second cutting was made during the first half of July.

Normally, at the time of the first cutting of alfalfa there is little or no injury by hoppers. By the time the second crop has matured, and sometimes the third, hoppers are present in numbers, and the injury is severe. There is no insecticide that can be used economically for controlling the insect in fields of alfalfa. However, injury may be lessened to a certain extent and confined mainly to one crop, if the cutting dates coincide with certain stages in the seasonal development of the insect.

CUTTING SCHEDULE BASED ON THE DEVELOPMENT OF THE LEAFHOPPER

It is especially necessary to consider two stages in the seasonal development of the leafhopper when deciding upon cutting dates for alfalfa. The first of these stages is the time of the appearance in the spring of adult hoppers in numbers; the second, the time of

the appearance of the maximum number of hoppers later in the season. Observations in the field show that adult hoppers appear in numbers in the spring about June 1, and are most numerous about July 25.

The adults lay some of their eggs in the first crop of alfalfa and these are destroyed when the crop is cut. When the cutting is delayed until near the full-blooming stage, the adults will have laid a large part of their eggs and there will be fewer leafhoppers on the second crop.

It is not possible to set an exact date for cutting the first crop, but from field observations on the development of the leafhopper, the first cutting should be made June 10 to June 15.

Alfalfa should be cut the second time when the hoppers have reached their maximum number and are beginning to decline. This takes place during the last week of July. By delaying the second cutting, very little damage will be done to the third crop, because the hoppers decrease rapidly in number after August 1. If the second crop has become yellowed, little additional damage can be done by delaying the cutting a few days longer.

The reduction in the season's yield will be less when the first cutting is made near the middle of June and the second delayed till the latter part of July, than when the first cutting is made near June 1 and the second July 20 or earlier. The quality of the third crop of hay is much better when first and second cuttings are delayed, because there is very little yellowing of the leaves of the third crop.

SUMMARY

The most noticeable injury to clover and alfalfa by the Potato Leafhopper is the stunting of the plants and the discoloring of the leaves.

Certain strains of red clover are more resistant to the leafhopper injury than others. The clovers which are non-pubescent or have appressed hairs on the foliage are the least resistant, French and Italian clovers are examples.

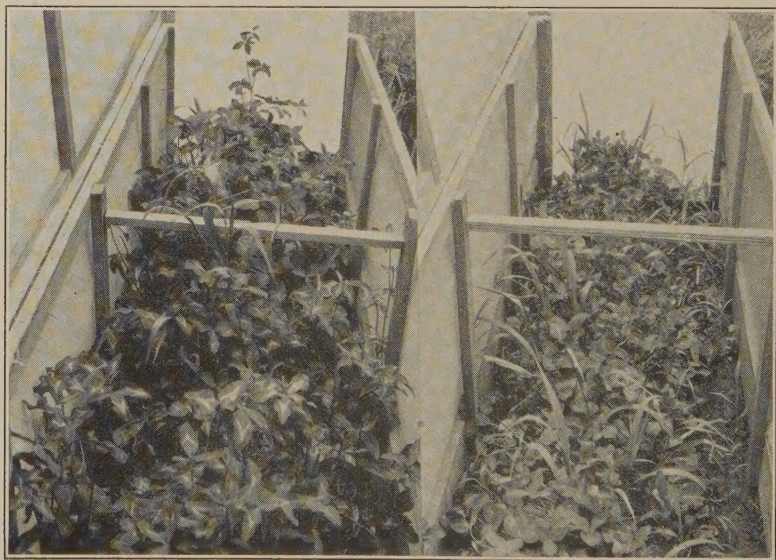
The native or hairy clovers differ in resistance to leafhopper injury. A Kentucky strain was found to be the most resistant. Adapted home-grown red clover seed should be used in Kentucky.

Different strains of alfalfa do not show any great differences in resistance to leafhopper injury.

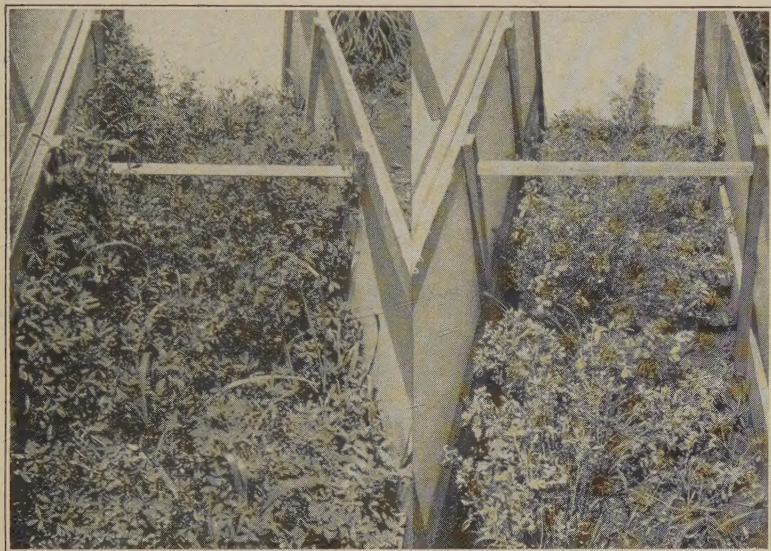
Usually, under field conditions, the injury from leafhoppers is not severe enough to cause the death of plants before winter, but their condition is weakened. Small plants, however, may die from injury. Plants infested in the summer do not seem to be more subject to winter-killing than uninfested plants, but there is some difference in size in the spring following infestation.

As a rule, the first crop of alfalfa is injured only slightly, if at all, but the second and sometimes the third crop is injured severely when hoppers are numerous. Adult hoppers appear on alfalfa in considerable numbers about June 1, and begin laying eggs on the first crop of alfalfa. By delaying the first cutting to near full-blooming of the alfalfa, June 10 to June 15, many eggs are destroyed in the first crop and there are fewer hoppers on the second crop and less injury.

The hoppers are most numerous on alfalfa about July 25 and decrease in number after that date. When alfalfa is cut during the last week of July, injury is confined mainly to the second crop and there is very little injury to the third crop.



Kentucky red clover, Ky. 1, of the same age; at the left, uninfested by leafhoppers; at the right, infested by leafhoppers.



Utah Grimm alfalfa of the same age; at the left, uninfested by leafhoppers; at the right, infested by leafhoppers.



Adult leafhopper, *Empoasca fabae* (left), and full-grown nymph. (Copied from Plate 1, Research Bulletin 78, Iowa Agricultural Experiment Station, by permission of the Director.) $\times 16$.

